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IS 14572 (1998, Reaffirmed 2006): Chloroform--Code of Safety. ICS 13.300

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IS 14572 : 1998

भारतीय मानक

क्लोरोफॉर्म — सुरक्षा संहिता

Indian Standard

CHLOROFORM — CODE OF SAFETY

ICS 13.300

Intranet Print
New Delhi

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

July 1998

Price Group 3

Chemical Hazards Sectional Committee, CHD 007

FOREWORD

This Indian Standard was adopted by Bureau of Indian Standards, after the draft finalized by the Chemical Hazards Sectional Committee had been approved by the Chemical Division Council.

Chloroform is widely used in the manufacture of chlorofluorocarbon refrigerants and propellants. It is used as solvent for waxes, fats, oils, resins, in the extraction and purification of penicillin and other pharmaceuticals, in the manufacture of artificial silk, plastics, floor polishes and in sterilization of catgut. It is also used in analytical chemistry as a reagent/solvent.

The major hazard of chloroform arises in repeated exposure to low atmospheric concentrations which may result in damage to liver, kidneys and heart. In high concentrations, it is sterilization of catgut. In high concentrations, it is narcotic and effective anaesthetic. Its contact with skin and mucous membranes may produce local irritation.

In the preparation of this standard, assistance has been derived from the following publications:

a) Chemical Safety Data Sheet SD-89 on Chloroform (1974);

b) 'Chloromethanes' Technical and Engineering Service Bulletin No. 21 (1966). Allied Chemical Corporation, USA;

c) Dangerous Properties of Industrial Materials (N. Irving Sax) (1984); and

d) NIOSH/OSHA Pocket Guide to Chemical Hazards (1978).

The Committee responsible for the formulation of this standard is given in Annex A.

AMENDMENT NO. 2 AUGUST 2007
TO
IS 14572 : 1998 CHLOROFORM — CODE OF SAFETY

(*Page* 2, *clause* 5.1.1) — Substitute the following for the existing:

'*Threshold Limit Value* – ACGIH Threshold Limit Value (TLV-TWA) – 10 ppm

ACGIH (TLV-TWA) – The TWA concentration for a conventional 8 h work day and 40 h work week, to which it is believed that nearly all workers may be repeatatedly exposed, day after day for lifetime without adverse effect.'

[*Page* 2, *clause* 5.4(a)] — Add the following at the end:

'Chloroform is a confirmed animal carcinogen.'

(*Page* 4, *clause* 9.3) — Add the following new clause at the end:

'10 FIRST AID MEASURES

10.1 Inhalation — Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

10.2 Ingestion — If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. Get medical attention immediately.

10.3 Skin Contact — Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Get medical attention immediately. Wash clothing before reuse. Thoroughly clean shoes before reuse.

10.4 Eye Contact — Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

10.5 Note to Physician — Because kidney and liver effects may be delayed, keep victim under observation for 24 to 48 h. Administration of fluids may help to prevent kidney failure. Obtain blood glucose, urinalysis, liver function tests, chest X-ray, and monitor cardiac function and fluid/electrolyte status. Monitor liver and kidney function for 4 to 5 days after exposure. Disulfiram, its metabolites, and a high carbohydrate diet appear to protect somewhat against chloroform toxicity. Do not give adrenalin. Tests may show increased bilirubin, ketosis, lowered blood prothombin, and fibrogen.'

(CHD 8)

Reprography Unit, BIS, New Delhi, India

AMENDMENT NO. 1 SEPTEMBER 2004
TO
IS 14572 : 1998 CHLOROFORM — CODE OF SAFETY

(*Page* 1, *clause* **4.1.4**) — Insert the following at the end:

'**4.1.5** CAS Registry No. : 67-66-3

4.1.6 UN No. : 1888'

(*Page* 1, *clause* **4.2.2**) — Substitute the following for the existing:

' **4.2.2** *Odour* — Pleasant, sweetish, ethereal odour, non-irritant.'

(*Page* 2, *clause* **5.1.2**, *line* 2) — Substitute '500 ppm (2 500 mg/m^3)' *for* '1 000 ppm (5 000 mg/m^3)'.

(*Page* 2, *clause* **5.1.2**) — Insert the following at the end and renumber the subsequent clauses:

' **5.1.3** OSHA PEL, STEL — 50 ppm (240 mg/m^3)'

[*Page* 2, *clause* **5.4**(a)] — Insert the following at the end:

'It may cause birth defects'.

(*Page* 3, *clause* **6.3.1**) — Insert the following at the end:

'For exposure range >50 to <500 ppm respiratory equipment should be of supplied air, constant flow pressure demand, full face type and for exposure range of 500 ppm and above self-contained breathing apparatus, pressure demand, full face type respiratory equipment should be used.'

(*Page* 4, *clause* **9.2**) — Insert the following at the end:

'or other non-combustible absorbent'.

(CHD 8)

Reprography Unit, BIS, New Delhi, India

Indian Standard
CHLOROFORM — CODE OF SAFETY

1 SCOPE

1.1 This code describes the properties of chloroform; the nature of hazards associated with it; personal protective equipment; storage, handling, labelling and transportation; spillage/leakage and waste disposal; fire prevention and fire fighting; training and health monitoring; and first aid.

1.2 This code does not deal with specifications of chloroform or for design of building or plants, storage vessels and equipments for operational control.

2 REFERENCES

The Indian Standards listed below contain provisions which through reference in this text, constitute provisions of this Indian Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this Indian Standard are encouraged to investigate the possibility of applying the most recent editions of the Indian Standards indicated below:

IS No.	*Title*
4155 : 1966	Glossary of terms relating to chemical and radiation hazards and hazardous chemicals
4167 : 1980	Glossary of terms relating to air pollution (*first revision*)

3 TERMINOLOGY

3.1 For the purpose of this code, the definitions given in IS 4155 and IS 4167 shall apply.

4 GENERAL PROPERTIES

4.1 General Information

4.1.1 *Common Name*	Chloroform
4.1.2 *Chemical Name*	Trichloromethane, methyl trichloride
4.1.3 *Chemical Formula*	$CHCl_3$
4.1.4 *Molecular Mass*	119.38

4.2 Physical Properties

4.2.1 *Physical State*	Colourless volatile liquid
4.2.2 *Odour*	Pleasant, sweetish, non-irritant
4.2.3 *Light Sensitivity*	Decomposes at ordinary temperature, in sunlight in the absence of air and in the dark in the presence of air. Phosgene is one of the oxidative decomposition products
4.2.4 *Freezing Point*	−63.5°C
4.2.5 *Boiling Point*	61.2°C
4.2.6 *Specific Gravity* (Liquid)	1.49 at 15°C
4.2.7 *Vapour Density* (air = 1)	4.1
4.2.8 *Vapour Presssure*	61 mm Hg at 0°C 200 mm Hg at 25.9°C 526 mm Hg at 50°C
4.2.9 *Hygroscopicity*	Hygroscopic
4.2.10 *Miscibility*	Immiscible with water. Miscible with alcohol, ether, benzene, solvent naphtha and carbon tetrachloride

4.3 Chemical Properties

4.3.1 In presence of excess moisture, strong alkalies, sunlight and high temperatures chloroform decomposes to highly toxic phosgene and hydrochloric acid.

4.3.2 Dangerous interchemical reactions are possible with certain chemicals as under:

a) Acetone — Violent reaction in the presence of potassium hydroxide;
b) Aluminium (powder) — Possible explosion;
c) Dinitrogentetraoxide — Explosion by impact;
d) Fluorine — Violent reaction;

e) Sodium hydroxide and methanol — Explosive reaction.

Also violently react with bisilane, lithium, magnesium, potassium, perchloric acid, phosphorus pentoxide, sodium, sodium methylate and potassium tertiary butoxide.

4.4 Fire and Explosion Hazards

4.4.1 Chloroform is non-flammable and non-explosive in air. It does not support combustion, but decomposes to liberate phosgene when involved in a fire. Its hot vapour in admixture with vapourized alcohol burns with a green-tinged flame.

4.5 Corrosion Properties

4.5.1 Chloroform is more susceptible to oxidation. The material of construction for the tank and process equipment require special consideration.

4.5.2 The ethanol inhibited grade of chloroform is not compatible with mild steel. Amylene inhibited chloroform can be handled in mild steel equipment if adequate care is taken to prevent contact with water or moist air.

5 HEALTH EFFECTS AND TOXICITY INFORMATION

5.1 Repeated exposure to low atmospheric concentration may result in damage to liver, kidney and heart. Contact with skin and mucous membranes may produce local irritation.

It is a suspected human carcinogen. Regular medical examination for persons engaged in handling of chloroform is advisable.

5.1.1 *Threshold Limit Value (TLV)* — 10 ppm (50 mg/m^3).

5.1.2 *Immediately Dangerous to Life or Health Concentration (IDLH)* — 1 000 ppm (5 000 mg/m^3).

5.1.3 Chloroform causes irritation of the conjuctivitis. On inhalation it causes dilation of the pupils with reduced reaction to light as well as reduced intra-ocular pressure.

5.1.4 It has been widely used as an anaesthetic. However, due to its toxic effects, this use is being abandoned. Prolonged administration as an anaesthetic may lead to such serious effects as profound toxemia and damage to the liver, kidneys, heart which leads to paralysis by cardiac respiratory failure and finally death. No cases of chronic poisoning due to chloroform have been reported.

5.2 Routes of Entry

5.2.1 The toxicologically important routes of entry are inhalation, ingestion and skin and/or eye contact.

5.2.2 Sustained contact of chloroform with skin may produce dermatitis at the site of contact and burns if left in contact with the material.

5.3 Acute Toxicity

a) In many respects, the toxic action of chloroform resembles that of carbon tetrachloride. The expected effects of various atmospheric concentrations are indicated in Table 1.

   The use of chloroform as a surgical anaesthetic abandoned because exposure to narcotic concentration was often followed either by sudden death through its effects on the heart and circulation or by severe injury to the liver.

b) When splased into eye, chloroform causes local pain and irritation but serious injury would not be expected.

c) Skin contact for single, brief exposures ordinarily causes little or no local irritation.

d) Ingestion of chloroform is followed immediately by severe burning in the mouth and throat, pain in the chest and abdomen and vomitting. Depending upon the amount swallowed loss of consciousness and liver injury may follow.

e) The tendency of chloroform to produce liver injury is significantly greater and faster in alcoholics and in persons with nutritional deficiencies.

5.4 Chronic Toxicity

a) Chloroform is a suspected human carcinogen.

b) Repeated exposure to well below the threshold value, may cause injury to the liver and kidneys.

c) Industrial experience has shown that daily exposure to concentrations below 100 ppm (490 mg/m^3) may result in a variety of symptoms referable to the nervous system and alimentary tract, in the absence of demonstrable evidence of injury.

d) The injury to the liver is similar to that caused by carbon tetrachloride but tends to be somewhat less severe than the latter. Injury to the kidney was usually less severe than liver injury. Repeated or prolonged contact

Table 1 Effects of Various Atmospheric Concentrations of Chloroform

(*Clause* 5.3)

Sl No.	Concentration		Response
	mg/m^3	ppm	
(1)	(2)	(3)	(4)
i)	70 000-80 000	14 336-16 384	Narcotic limiting concentration
ii)	20 000	4 096	Vomitting, sensation of fainting
iii)	7 200	1 475	Dizziness and salivation after a few minutes exposure
iv)	5 000	1 024	Dizziness, intracranial pressure and nausea after 7 minutes Definite after effects : fatigue and headache still felt hours later.
v)	4 900	1 000	IDLH
vi)	1 900	389	Endured for 30 minutes without complaint
vii)	1 000-15 000	205 - 307	Lowest amount that can be detected by odour
viii)	100 - 350	20-70	Slight subjective complaints may occur

with the skin, may result in local irritation and inflammation.

6 STORAGE, HANDLING, LABELLING AND TRANSPORT

6.1 Storage

Chloroform is susceptible to oxidation. The material of construction for the tank and process equipment requires special consideration. The ethanol-inhibited grade of chloroform are not compatible with mild steel storage and handling equipment. The use of stainless steel — lined mild steel, nickel clad steel, or stainless steel of the 300 series, for this is suggested. Amylene inhibited chloroform can be handled in mild steel equipment if adequate care is taken to prevent contact with water of moist air. Aluminium is not recommended as chloromethanes, under certain conditions, can react with aluminium to form explosive mixtures. Strict maintenance of the drying columns in atmospheric breathing storage tanks should be employed.

6.1.1 The storage tank capacity should be sized for about 10 percent greater volume than the maximum quantity of chloroform it will contain, to allow for liquid expansion with increasing temperature. The tank may be fabricated of all welded mild carbon steel designed for a liquid density of 1.34. If it is to be used in a closed system it should be designed to withstand full vacuum and an internal pressure. Tanis should be protected against over-pressure by means of safety rupture disc.

6.1.2 Precautionary measures should be taken to ensure that moisture does not contaminate the solvent. To minimize evaporation losses, a completely sealed storage tank is recommeded.

Used tanks may require manual cleaning. Iron scrapper and wire brush may be used to remove any hardened sediment and oxide coating which may be in evidence. Scrubbing the interior with solution of commercial detergent, followed by a thorough water rinse, will remove most of the contaminants. The tank must be absolutely dry before it is charged with product.

6.2 Transport

6.2.1 As per United Nations Recommendations for Transport of Dangerous Goods, Chloroform is classified under Class 6.1 — Poisonous (Toxic) substances and UN Number is 1888.

6.2.2 Follow code symbols and other precautionary measures listed in the UN Recommendations and Government Regulations.

6.3 Handling

6.3.1 *Personal Protecting Equipment*

Wear safety goggles, self contained breathing apparatus, air line mask, hand gloves.

6.3.2 Trucks are usually equipped with pumps driven by a power take-off. They are essentially self-unloading with operations performed by the truck driver. It is customary to unload cars by means of rotary or centrifugal pump connected to the bottom outlet of the car by means of a flexible connection. Since the liquid is volatile, it is necessary to ensure adequate net positive suction head for the pump to prevent flashing the pump intake and loss of capacity.

6.3.3 *Pump*

Positive displacement rotary pumps are recommended for chloroform service. Submerged centrifugal pumps may be used in storage tanks designed for atmospheric service. Externally mounted flooded suction centrifugal pumps may be used if care is taken to provide adequate suction head.

6.3.4 *Piping*

Piping may be of steel or black iron, preferably with welded or flanged joints. Lubricant for threaded joints must be of a type resistant to chloroform, such as white lead, graphite and glycerine pastes or fluorocarbon tape. Compressed or screwed asbestos gaskets are recommended for flanged joints. Grounding connectors should be installed around such joints.

6.3.5 Flanged or screwed iron gate or globe valves may be used. Stainless steel trim is recommended to protect against corrosion where the liquid may be exposed to the atmosphere.

6.3.6 Metallic hose of monel, stainless steel or mild steel may be used for flexible connections. Mild steel hose, if disconnected between periods of use as in unloading cars or trucks, should be cleaned and dried or protected from exposure by blanking off the open ends until needed again. All natural and synthetic rubber and PVC are to be avoided.

6.3.7 It is recommended that some type of line filte be installed between storage and process to remov any particulate contamination.

7 FIRE PREVENTION AND FIGHTING

7.1 Chloroform will not burn in air or suppo combustion and does not present a fire hazard. Howeve chloroform and its decomposition products ar hazardous. Therefore self-contained breathin apparatus should be used.

8 SPILLS AND LEAKS

8.1 The most important danger of chloroform arise from the fact that repeated exposure to low atmospher concentrations may result in damage to liver an kidneys. In high concentrations, chloroform has narcot properties. Contact with skin and mucous membrane may produce local irritation.

8.2 In case of spill or leak of small quantity, absor the material by pouring sand or earth. However, in cas of major (large) quantity spill or leak, dispose off th materials by atomizing in a combustion chamber.

8.3 Wear respiratory protection while approachin heavy leakages.

8.4 Prevent contact with skin, eyes.

9 WASTE DISPOSAL

9.1 All local and state regulations concerning was disposal to streams, municipal treatment plants, or i to the ground shall be determined and complied wit

9.2 Small quantities of chloroform can be dispose off by pouring on dry sand or earth.

9.3 Large quantities of waste mixture can be dispose off by atomizing in a combustion chamber.

ANNEX A

(*Foreword*)

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(*Continued on page* 6)

(*Continued from page 5*)

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